

# HVAC Repair and Maintenance Strategies (Demystifying HVAC)

by Ron Prager

The PRSM editorial board recently raised the question of the “best,” strategic approach to HVAC maintenance. Of course, there is no one best strategy to be implemented because so many variables must be considered when planning your specific strategy. What follows is a discussion of the specific options open to facility managers and the variables to consider when designing an HVAC program.

**Breakdown maintenance:** This is basically for those who believe that the cost of preventive maintenance cannot be justified. No filter changes or preventive maintenance procedures are performed on a scheduled basis. Those who practice this model believe, or answer to people who believe that fixing only what is broken, and only when it affects store comfort is the least costly strategic direction for their company. This option may be deemed appropriate in pop-up locations.

**Scheduled Filter Replacement:** This is for those who have come to the realization that air filters get clogged after a certain number of hours of blower operation. They have learned that it is less costly to replace filters on a scheduled basis than it is to replace them when clogged filters have reduced air flow to the point that they have caused catastrophic component failure, or an inability to heat or cool the space adequately. Scheduled filter replacement is always more cost effective than demand filter replacement because replacing filters on a demand basis normally requires two visits by a technician. The first visit is for diagnosis and the second visit is to replace the filters after the sizes and quantities have been determined.

**Preventive Maintenance:** The preventive maintenance process can include anything from a simple visual inspection annually to proactive replacement of components based on run time, regardless of whether they have failed. Most programs for retail stores fall somewhere within this range.

**Emergency Replacement:** At some point an HVAC system will experience a major component failure that results in a repair that the facility manager feels he or she cannot justify based on the repair cost and the age or condition of the unit. At this point the equipment must be replaced with whatever equipment is obtainable quickly.

**Proactive Replacement:** Based upon the age and condition of HVAC assets, and the lease term for each site, a fixed amount of capital is set aside annually to fund replacement of a certain percentage of the assets. The facility manager is able to obtain exactly the equipment required, with the factory installed options necessary, and the installation can be scheduled and managed to have lowest cost as well as minimal impact to the store.

## Determining Your Strategy:

### Air Filters:

So, how do you determine what model or combination best fits your application? Let’s start with the easy stuff. Depending on a large number of factors including hours of operation, store traffic, filter rack size, product sold, and geographic location, air filters will clog within a time period that ranges from 30 days to 150 days. This is true for both pleated filters and flat filters. While pleated filters may contain three times the quantity of media contained in flat filters, they are usually three times as efficient as flat filters; so both types tend to load up at the same rate. If you can afford pleated filters, there is no

question that they are superior to flat filters, however the cost of a pleated filter is between 50% and 100% more than the cost of a flat filter. How much are you willing to pay for a pound of dirt? Typically,



How long before these filters cause other issues?

air filters are replaced on a scheduled quarterly basis. This works for most stores in most locations. If you are dispatching service calls for issues caused by clogged filters, you will need to increase the filter change frequency at the stores with those issues. There is no question in my mind that scheduled filter replacements are justified and cost effective for all systems serving retail stores with the exception of those served by Variable Air Volume (VAV) systems. VAV systems usually modulate the flow of conditioned air furnished by the landlord's equipment. VAV boxes may be classified as "Fan Powered," and "Damper Only," boxes. There are no air filters to replace on the "Damper Only," boxes. In most cases replacing air filters twice each year is sufficient on "Fan Powered," boxes.

#### **Drive belts:**

Drive belts are the link between the blower motor and the blower wheel in an air conditioning system. These belts are typically made from reinforced neoprene. The average life of a drive belt in a typical retail store is a little more than one year. Belts come in several different widths and hundreds of different lengths. Most vendors stock the most popular drive belts on their service trucks, however the chances of a service tech having the exact replacement belt on his truck is still slim. If belts are replaced on a demand basis, typically, the retailer will pay for an initial visit to diagnose the defective belt and a return call to replace the belt. If a belt is replaced annually on a preventive maintenance visit you can anticipate an average cost of \$40.00 included in the PM cost. If the belt fails and is replaced on a demand basis, the repair cost will average of \$230.00 during normal hours. Even if belts had a lifespan of 2 years, there is still a savings of \$150.00 per unit associated with replacing drive belts proactively. There is one exception here. Units with cooling capacities of less than five tons may utilize direct drive blowers. In this case there are no drive belts to replace. Know the size of the units in your asset list and only replace belts on the units that actually have belts.



When do you replace a drive belt?

### Heating Start-Up:

One can make a valid argument for pre-season heating system start-ups. A preventive maintenance inspection will prevent a certain percentage of emergency calls. There are maintenance procedures such as lubrication that should be performed at six month intervals, and it can be proven that making minor repairs proactively, can prevent catastrophic failures of major components later. These are good reasons to perform a heating start-up on any type system. There is also the realization that the largest percentage of retail sales occur during the months of November and December and these are heavy heating months throughout most of the country.



Fire in heating compartment due to birds nest could have been avoided with a pre-season inspection

If you use gas fired equipment to heat your stores, there is one more extremely important justification for having qualified professionals inspect heating systems at least once each year. The legal terms "Gross negligence," and "Liability," come into play here. Due to the possibility of Carbon Monoxide poisoning and building fires, it is usual and customary within the industry to have heating systems inspected prior to the start of the heating season. Unfortunately we live in a very litigious society and if someone suffers harm, it is typical to look for compensation. Should you have a Carbon Monoxide incident or a fire in one of your HVAC units and you failed to have the system inspected by a qualified

professional, there is a possibility the facility manager will be found negligent with respect to the incident, as he or she was ultimately responsible for determining the scope of maintenance. If negligence is proven, insurance companies may refuse to pay any personal injury or property claims. There is also the possibility of criminal charges if the incident causes serious permanent injury or death. If you doubt this, Google "Carbon Monoxide Poisoning," and see how many hits you get for personal injury attorneys. Heating start-ups are a must if you are using gas fired equipment, and they are an excellent idea on all other systems. Combine your heating start-ups with an air filter change and incur an average cost of an hour's worth of technician time for each unit. The peace of mind alone is worth the expense.

### **Cooling Start-Up:**

Cooling season inspections are justified for almost all HVAC systems. With the exception of preventing Carbon Monoxide issues and fires, the need to perform a pre-season inspection aligns with the need to perform a heating inspection. Money spent on a cooling inspection is well spent. Clean the condensate pan now and avoid condensate leaks later. You may also be avoiding a customer slipping on the wet floor caused by the condensate leak. Replace a condenser fan motor with noisy bearings now and avoid the 4:00 PM emergency call for the only unit servicing the store being down. Discover that the condenser coils need cleaning in the Spring, rather than shortening compressor life by forcing the compressor to run all summer at high head pressures and high current draw.

HVAC systems really do work harder as the outdoor temperatures increase and systems that are barely staying on line at moderate temperatures, fail when temperatures soar. Most units with capacities of 7.5 tons or more use multiple stages of cooling. When the systems are lightly loaded they run a single



Refrigerant leak discovered on cooling inspection. This will take 2 days to repair. Can you afford the down-time during the cooling season?

compressor to satisfy the load. As outdoor temperatures and the number of occupants increase, so does the cooling load and the unit energizes additional compressors and condenser fans. A store that is comfortable on an 80°F Tuesday may be unbearably hot on a 90°F Saturday afternoon. A cooling season inspection will also identify equipment that is not operating efficiently and allow you to rectify the cause. Aside from being green, this will also allow you to reduce your energy costs. While on the

subject of “Green,” inspections allow technicians to identify and repair refrigerant leaks. This serves three functions as your equipment will only operate efficiently when it contains the correct refrigerant charge, you will avoid evaporator coil freeze-ups and the resulting condensate leaks, and you will have prevented additional leakage of R22 to the atmosphere.

Cooling inspection scope and the handling of proposals for repair work found while performing a PM, should be determined based on budget and corporate culture. If you are selling \$3000.00 gowns or chocolate, equipment downtime is disastrous. If you are selling two by fours or games to teenagers, there is a lot more leeway in terms of comfort. To maximize the productivity on a cooling inspection, have the technician rate the condition of the equipment and record it. This will help you with your asset replacement strategy.

### **Replacement:**

Every mechanical system has an anticipated lifespan. This usable lifespan is determined by factors such as geographic location, number of operating hours, and quality of maintenance. Facility managers are tasked with finding solutions that are most cost effective, while staying within budget. In the HVAC world, this involves developing a proactive replacement strategy and evaluating repair versus replace options when reviewing proposals.

The first step in planning your replacement strategy is to plot spend versus age for all HVAC assets. This should be broken out by equipment type, because different types of equipment will have different life expectancies. Use this as a guide along with condition reports when evaluating replacement candidates. The best strategy is sometimes still going to be an educated guess, but there will also be those situations that fall into the “No brainer,” category. One mistake to avoid is to assume that a unit that required major repairs last year should be replaced because it will require major repairs next year. This may, or may not be the case depending on the condition of the components that were not replaced recently. Let’s say you replaced a compressor last year in a five ton unit with electric heat. The unit is 15 years old, but your exposure to major future repairs is slim for the next couple of years. Now let’s say you replaced one of two five ton compressors in a ten ton unit, the same age, with gas heat; you now have the exposure of having to replace a heat exchanger and or a second compressor over the next few years.



This is an 8 year old unit with a bad compressor. Do you really want to replace the compressor?

Today, we really need to evaluate the repair versus replace option for every major repair on equipment exceeding 8 years of age. I can already hear a chorus shouting 15 years, 13 years, 10 years, but the world has changed. Refrigerant 22 is being phased out and as a result I believe the cost of refrigerant and replacement parts for R22 equipment will increase at a rapid rate, and the availability of replacement parts for R22 units will decline. The wholesale cost of R22 has doubled over the past two years and no manufacturer wants to be left with shelves full of replacement parts for equipment that uses R22. In addition, equipment efficiencies are increasing substantially and there may be rebates

available for replacing inefficient equipment. Consider cost of operation, cost and probability of future repairs, possible rebates, and future parts availability as well as the lease term when choosing repair versus replacement of an existing unit.

In the paragraphs above, I have attempted to present some high level considerations for developing your HVAC strategy, but I have left out the most important consideration of all, and that is working with a competent vendor that you trust. PM programs don't work unless the equipment is actually being maintained, and good vendor can be invaluable in determining cost effective solutions as long as they are capable of partnering with you to further the best interests of your company.